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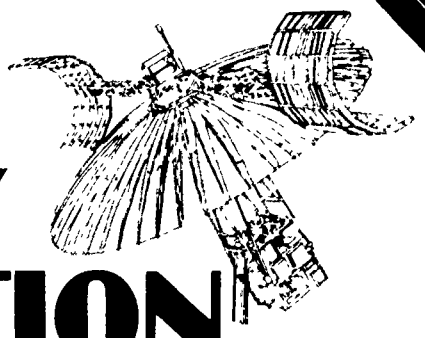
ABSTRACT

Intimately involved in any equipment system is the human factor. The people operating the equipment at the remote installations for the Satellite Technology Demonstration (STD) were different from paid employees or from private consumers. The STD site operators were paid only token fees; thus, they are best describd as having been motivated by the service benefits of the system. Indeed, a survey of their interests and capabilities at the onset of the project showed little or no inclination for communications-type equipment. Although not necessarily unsolvable, the problem of training people to operate communications equipment is complex and unique. The STD, therefore, studied the stages and factors involved in training site operators. Initially, the prior experiences and capabilities of the site operators were isolated to provide a base of information against which the effects of the STD experience could be measured. Sequentially evaluated therefore were: (1) training; (2) initial results of the training program; (3) site operator performance throughout the demonstration; and (4) psychological disposition toward the hardware configuration. (Author/EMH)

SATELLITE TECHNOLOGY DEMONSTRATION



FEDERATION OF ROCKY MOUNTAIN STATES, INC.

technical report

TR0419

THE STD SITE OPERATOR

JEAN BRAUNSTEIN

ABSTRACT

Intimately involved in any equipment system is the human factor. The people operating the equipment at the remote installations for the Satellite Technology Demonstration (STD) were different from paid employees or from private consumers. The STD site operators were paid only token fees; thus, they are best described as having been motivated by the service benefits of the system. Indeed, a survey of their interests and capabilities at the onset of the Project showed little or no inclination for communications-type equipment. Although not necessarily unsolvable, the problem of training people to operate communications equipment is complex and unique. The STD, therefore, studied the stages and factors involved in training site operators.

Initially, the prior experiences and capabilities of the site operators were isolated to provide a base of information against which the effects of the STD experience could be measured. Sequentially evaluated thereafter were: (1) training; (2) initial results of the training program; (3) site operator performance throughout the Demonstration; and (4) psychological dispositions toward the hardware configuration.

SITE OPERATOR PROFILE

The qualifications for remote site operators did not reflect the STD's broadcast and engineering needs during the developmental stages of the Demonstration. Instead, site operator qualifications were based on the Project's programming, field services, and research needs.

A survey, the "Site Operator Profile," was used to identify those factors prior to the STD experience which were likely to influence quality of performance during the Project. Three factors were selected: interest, training, and capabilities in technology, particularly communications equipment. The results from the survey items designed to measure these factors are summarized in Table 1.

Question 1 responses showed that approximately 50 to 60 percent of all respondents (prior to their STD experiences) were interested in photography (59.6 percent), and/or machine repair (55.8 percent), and/or audio systems (48.0 percent), with a similar distribution of responses

TABLE 1

STD SURVEY

SITE OPERATOR PROFILE

	IT'S	ROT'S	ALL SITES		IT'S	ROT'S	ALL SITES
# RESPONSES	21	31	52		21	31	52
QUESTION 1. HOBBIES (SPECIAL INTEREST)				QUESTION 2. TRAINING			
--	--	--	--	ELECTRONICS	95.71	77.42	80.77
PHOTOGRAPHY	52.38	64.52	59.62	PHOTOGRAPHY	33.33	16.13	23.08
MACHINE REPAIR	52.38	58.06	55.77	MECHANICS	14.29	32.26	25.00
AUDIO SYSTEMS	57.14	41.94	48.08	AUDIO VISUAL SYSTEMS	66.67	67.74	67.31
SHORTWAVE RADIO	19.05	6.45	11.54	TWO-WAY RADIO	28.57	22.58	25.00
OF THE ABOVE SHORT-WAVE RADIO WITH FCC LICENSE	(75.00 OF ABOVE)	--	(50.00 OF ABOVE)	--	--	--	--

	IT'S	ROT'S	ALL SITES
# RESPONSES	21	31	52
QUESTION 3: SELF-PERCEIVED CAPABILITIES			
A-V PROJECTORS			
HIGH CAPABILITY	52.38	61.29	57.69
MODERATE CAPABILITY	38.10	35.48	36.54
LOW CAPABILITY	4.76	3.23	3.85
NO CAPABILITY	4.76	--	1.92
A-V RECORDING			
HIGH CAPABILITY	57.14	35.48	44.23
MODERATE CAPABILITY	28.57	48.39	40.38
LOW CAPABILITY	4.76	6.45	5.77
NO CAPABILITY	9.52	9.68	9.62
OFFICE MACHINES			
HIGH CAPABILITY	4.76	16.00	7.84
MODERATE CAPABILITY	38.10	30.00	33.33
LOW CAPABILITY	42.86	40.00	41.18
NO CAPABILITY	14.29	20.00	17.65
COPIERS			
HIGH CAPABILITY	47.62	45.16	46.15
MODERATE CAPABILITY	42.86	41.94	42.31
LOW CAPABILITY	4.76	6.45	5.77
NO CAPABILITY	4.76	6.45	5.77
PHOTO EQUIPMENT			
HIGH CAPABILITY	30.00	6.67	16.00
MODERATE CAPABILITY	25.00	36.67	32.00
LOW CAPABILITY	10.00	46.67	32.00
NO CAPABILITY	35.00	10.00	20.00
TELEGRAPH EQUIPMENT			
HIGH CAPABILITY	5.00	5.33	4.00
MODERATE CAPABILITY	25.00	6.67	14.00
LOW CAPABILITY	10.00	16.67	14.00
NO CAPABILITY	60.00	73.33	68.00
TWO-WAY RADIO			
HIGH CAPABILITY	15.00	3.33	8.00
MODERATE CAPABILITY	30.00	20.00	24.00
LOW CAPABILITY	20.00	30.00	26.00
NO CAPABILITY	35.00	46.67	42.00

between Intensive Terminals (IT's) and Receive-Only Terminals (ROT's). "Mechanics" included automotive repairs, household appliances, small machine repairs, and other machine-oriented skills. Only a small percentage (11.5 percent) had special interest in shortwave radios; this percentage was somewhat higher for IT than for ROT operators (19.0 percent vs. 6.4 percent). The response to the shortwave-radio question indicated that most site operators--before joining the STD--had no special interest in technologically-advanced communications equipment.

Responses to Question 2 indicated that 80.8 percent of the respondents had some training in noncommunications related electronics and that 67.3 percent had some training in audio-visual systems. Smaller percentages of the respondents indicated training in other categories, including two-way communications (25 percent).

The results of Question 3 showed that a large percentage of the respondents perceived themselves as capable of operating communications equipment: audio-visual projectors (57.7 percent "high capability" and 36.5 percent "moderate capability"); audio-visual recording equipment (44.2 percent "high capability" and 40.38 percent "moderate capability"); and copiers (46.15 percent high capability and 42.31 percent moderate capability). A smaller number indicated capabilities in the photographic equipment category (only 6.7 percent "high capability" and 36.7 percent "moderate capability"). A few respondents indicated "high capability" in office machines, telegraph equipment, and two-way radio equipment. Further, the greatest percentages of "low" or "no capability" responses were in the telegraph and two-way radio equipment categories.

Based on these results, conclusions were drawn about the people surveyed concerning their experiences prior to the STD project. Although a large percentage of persons indicated special interest, training, and capability relative to familiar types of technological equipment--particularly classroom audio-visual equipment--an equal percentage indicated no special interest, training, and capability relative to the same or other types of technological equipment. Further, a predominant percentage had no special interest, training, or capabilities in communications equipment, as indicated in the responses to the shortwave and two-way radio questions.

TRAINING

In November, 1973, the STD's engineering staff developed a "Simulation and Prelaunch Test Plan" for operations. In January, 1974, the plan was successfully prototyped and was further modified as the various inter- and intra-HET project changes occurred. A systems specification document, The Broadcast and Engineering Training Manual for HET Network Site Operators, was produced in June, 1974. From time to time, minimal revisions and updates dealing with details of network operations were issued to site operators.

The following excerpt from the "Introduction" to The Manual (Broadcast and Engineering, pages 1 and 2) summarizes the tasks performed by the site operators:

> This manual is written from the Broadcast and Engineering perspective. Its aim is to train the site operator in four areas: (1) description, use, and care of the STD equipment; (2) protocol procedures, including contingency actions in malfunction situations and reporting procedures for equipment failures; (3) standard tests, checks and measurements to be performed; and (4) broadcast schedules.
>
> Section II provides an explanation of the unique communications systems being implemented in the Demonstration, including particular communication capabilities of the participating remote sites. It proceeds from a general account of the communications network to more detailed description of those areas with which the site operator will be most concerned.
>
> Section III contains prescribed standards to be maintained throughout the Project. Included are the guides outlining ROT and IT operational procedures, station call letters, standards to be adhered to in using the voice transmit function of the VHF Transmitter-Receiver system, failure reporting procedures, and contingency actions.
>
> Section IV describes data to be gathered and includes an explanation of the standardized computer forms that will be used for recording information. The accuracy that is needed for these data related tasks cannot be overemphasized.
>
> Section V discusses the broadcast schedule guide that will be mailed periodically and outlines preprogram and postprogram events.

A three-step plan originally was developed for training site operators:

1. Project engineering would train and test regional-level field service personnel.
2. Regional personnel then would train and test state-level field service personnel.
3. State personnel, in turn, would train and test the local site operators.

In practice, the plan was modified by omitting Step 1. In its place, Project engineering staff directly trained and tested the state coordinators. One week was allowed for trainees to read The Manual, followed by a two-day session at the regional offices in Denver. The first day was an eight-hour intensive training session, including necessary equipment demonstrations. The second day consisted of a four-hour question and explanation period, followed by a written examination. In 1974, the state coordinators demonstrated operational competency during a series of preoperational checkouts.

Nine state coordinators, one from each of the seven states and two from Nevada, underwent the complete technical training program and passed the written examination. Of the 50 multiple-choice questions in Part I, no one answered more than eight wrong; and of the 20 true/false questions in Part II, no one answered more than four wrong. Maximum limits had been set at 10 wrong for Part I and five wrong for Part II. An item analysis indicated that incorrect answers were evenly distributed among the various questions with no one item having more than five incorrect answers. Upon completion of the training program and test and after observation of preoperational performance, the state coordinators were evaluated as capable of training people at the local level.

The final step differed from the original plans: The STD decided to use state coordinators rather than local personnel (site coordinators) to train the site operators. Financial constraints, limited time, and the late hiring of site personnel were factors which influenced the STD's decision.

A 20-minute presentation by the engineering staff, including a six-minute demonstration film, was transmitted via the satellite network during a three-day preservice training and orientation period, which covered all aspects of the Project. The regional presentations were transmitted to site operators and their respective state coordinators who were clustered at eight locations within the region. A constraint on this presentation was that, few, if any, of these people had The Manual prior to the preservice session, which was held at the end of August, 1974.

The written examination, designed to test for initial evidence of competency, was given, in some instances, immediately following the preservice sessions. In other cases, it was

administered at a later date. There were also cases in which the instrument was used as a learning reinforcement device.

Although the site operator training program was late in its implementation, the STD's engineering staff was informed that the local site operators were sufficiently competent to initiate operations. A sampling of 37 examinations given to site operators was returned for an item analysis. This analysis indicated that the site operators had no more than seven incorrect responses in Part I and no more than four incorrect responses in Part II, with an even distribution of incorrect responses among the various questions.

The STD concluded that the time allocated--and subsequently expended--for site operator training was both necessary and worthwhile. This training not only helped to insure accuracy, thoroughness, and strict network discipline, but it also helped to maximize site operator permance.

SITE OPERATOR PERFORMANCE

For the operational phase, the STD developed a site status reporting system to record, analyze, and account for all remote site equipment information as it was received by the STD's Broadcast and Engineering Component. The nature of that system made it possible to deduce the adequacy of site operator performance.

Information for the site status reports came from the following:

1. The Network Coordination Center's special direct-dial telephone, which was used to provide the most recent data about existing conditions at an installation and to effect equipment repairs as rapidly as possible.
2. Computer-coded information, compiled on OMR (Optical Mark Read) cards, which were used to provide periodic data for cumulative studies and for comparisons between sites, as well as for individual site diagnosis when problems occurred.
3. Repair reports, which were compiled by the STD's Maintenance and Repair Team Supervisor.
4. Weekly reports by the STD's field services personnel.
5. Site status reports by the STD's research personnel.

It was hypothesized initially that the first three sources would be sufficient for all reporting needs. Subsequently, however, the last two sources provided information which had not been routed through specified channels.

The first month of operations (September, 1974) was spent bringing up site operator reporting and equipment performance to predefined standards; to the point at which site operators could perform all required tasks correctly. Problems included improper use of equipment and incorrect reports. These deficiencies made it difficult to assign specific percentages to adequate and inadequate site operator performance. Instead, estimates (drawn from field reports and other sources) were used. OMR reports, for example, suggested that from the onset of operations, approximately 50 percent of the site operators sufficiently understood and effectively performed all the engineering tasks. Further, the OMR cards clearly indicated the daily "all go" status of all equipment and signals for the month, including no failures of any kind.

The OMR reports, coupled with data from other sources, indicated that: (1) 25 percent of the site operators, for the first month of operations, did not totally understand Broadcast and Engineering procedures; and (2) 25 percent had reporting difficulties. (Hardware-caused malfunctions during September, 1974, involved less than one percent of all remote sites.)

To improve site-operator performance, Broadcast and Engineering personnel adopted a series of remedial strategies, including written memos, operational briefings, and phone conversations. Thereafter--from October 7, 1974 to February 29, 1975--site operator performance improved in all aspects of operations, including equipment usage, NCC reporting procedures, and OMR reports. From October 7 to October 26, 1974, operator error accounted for less than one percent of broadcast downtime, with a subsequent decrease in operator errors. Causes for operator error after October 26, 1974, were traced to operator absence and operation of equipment by substitute personnel.

The problems incurred during the first month of operations resulted in the following:

1. Broadcast and Engineering (B & E) repair support was hampered, and there were delays in repair services.
2. The technical information needed for operation and cumulative evaluations was both questionable and unreliable.

3. The onset of accepting B & E technical data for evaluation had to be postponed until October 7, 1974.
4. NCC coordination of the terrestrial systems in the satellite network was extremely difficult and somewhat inefficient.

With improved operator performance (post-September, 1974), the situation was reversed: B & E repair support services were improved; the technical data was accurate, reliable, and valuable for diagnostic and analytic purposes; and NCC coordination of the terrestrial systems in the satellite network became a simple and efficient task.

SITE OPERATOR PREFERENCE AND OPINION POLL

Equipment Use, Operational Procedures, and Hardware Data Requirements

The Broadcast and Engineering Training Manual for HET Site Operators contains detailed information about remote-site operator usage, operational procedures, and equipment checks and measurements. That information is summarized below.

The remote terminal configuration was developed with the nontechnical background of the user in mind. Specifications for operational procedures and evaluation requirements were written as simply as possible. B & E personnel attempted to balance conjectured site-operator capabilities and total HET network requirements. Multitime zones, limited and specific time use of the network by each of the six HET experimenters, and information needed for daily satellite control and configuration were some of the factors that influenced final requirements for the remote terminal operator. In turn, the site operator, by both opinion and performance, was able to confirm or deny the validity of those requirements.

A separate "Site Operator Opinion Poll" was developed to examine the psychological disposition of the user at various times throughout the Demonstration. Questions 1 and 2 in Table 2 were used to determine a site operator's attitudes toward using the equipment, following operational procedures, and gathering data.

The poll indicated that 100 percent of the respondents found the equipment easy to use, 95 percent felt that operations and procedures were interesting and easy; and 90 percent indicated

TABLE 2

STC SURVEY - NOVEMBER 1974

		IT'S		ROT'S		ALL SITES	
	# RESPONSES	21		31		52	
EQUIP USE	EQUIP EASY TO U[illegible] MEAN ON SCALE FROM 1 TO 5*	4.81		4.77		4.79	
	STRONGLY AGREE	80.95	100	77.42	100	78.85	100
	AGREE	19.05		22.58		21.15	
	NEUTRAL	0		0		0	
	DISAGREE	0		0		0	
	STRONGLY DISAGREE	0		0		0	
EQUIP USE AND OPERAT PROC.	EQUIPMENT INTERESTING MEAN ON SCALE FROM 1 TO 5*	4.62		4.61		4.62	
	STRONGLY AGREE	66.67	95.24	70.97	96.78	69.23	96.15
	AGREE	28.57		25.81		26.92	
	NEUTRAL	4.76		0		1.92	
	DISAGREE	0		0		0	
	STRONGLY DISAGREE	0		3.23		1.92	
	EQUIP ENABLES EASY TO DO MEAN ON SCALE FROM 1 TO 5*	4.65		4.42		4.51	
	STRONGLY AGREE	70.00	95	61.29	87.10	64.71	90.20
	AGREE	25.00		25.81		25.49	
	NEUTRAL	5.00		9.68		7.84	
	DISAGREE	0		0		0	
	STRONGLY DISAGREE	0		3.23		1.96	
OPERAT PROC & DATA REQUIRE	OMNI EASY TO MEAN ON SCALE FROM 1 TO 5*	4.52		4.57		4.55	
	STRONGLY AGREE	61.90	90.47	60.00	96.67	60.78	94.31
	AGREE	28.57		36.67		33.33	
	NEUTRAL	9.52		3.33		5.88	
	DISAGREE	0		0		0	
	STRONGLY DISAGREE	0		0		0	

* 1 = Strongly Agree ... 5 = Strongly Disagree

that procedures and data requirements (specified in The Broadcast and Engineering Manual for HET Operators) were easy. The mean for all categories on a scale from 1 ("strongly disagree") to 5 ("strongly agree"), was 4.4.

Clearly then, the STD site operators were inclined toward, and accepting of the equipment, procedures, and engineering data-gathering requirements. The 3.23 percent of ROT operators who found equipment checks difficult were working at uniquely-configured installations. The equipment item, a Hewlett-Packard receiver, was not easily accessible, it was, for example, placed in a separate room or on a mountain peak. Therefore, the equipment checks were quite inconvenient.

Parabola Adjustments

Occasional adjustments at some sites were necessary to accommodate the orbital changes of the ATS-6. Parabola elevation adjustments served to tilt the dish up or down, relative to the satellite position. These adjustments were made manually or, if the parabola was motorized, electrically. Manual adjustments involved going outdoors and rotating the gripping bars at the rear of the parabola until the highest signal strength reading was obtained from the site operator's portable signal strength meter. When parabolas were motorized, a single toggle switch, located indoors, was manipulated to maximize the signal strength reading of the Hewlett-Packard receiver.

Parabola azimuth adjustments moved the dish from left to right, relative to the satellite position. Adjustments were done manually, outdoors, and required a degree of physical strength. The site operator loosened the nuts in three main areas on the base of the parabola support structure (two places on the front yoke and one at the rear), then swung the parabola left or right while observing the portable signal strength meter in order to obtain an optimum reading. A length of pipe was helpful in providing leverage for swinging the parabola. Initially, it was estimated that the azimuth adjustments would be done infrequently.

Empirical data (collected from September, 1974 to April, 1975) was used to determine how site operators responded to making parabola adjustments. The data from these surveys (shown in Table 3 and Table 4) indicated the following.

TABLE 3

...TO SURVEY

NOVEMBER 1974

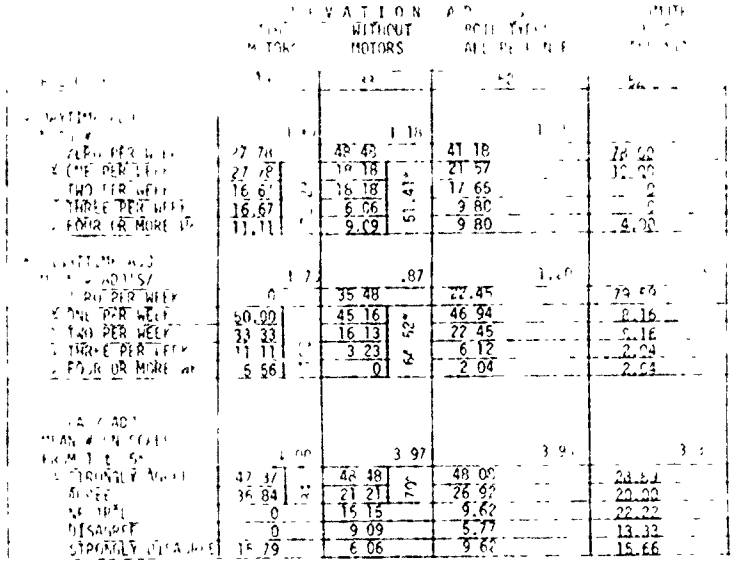


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TABLE 4
STD SURVEY
APRIL, 1975

ELEVATION ADJ'S

	WITH MOTORS	WITHOUT MOTORS	BOTH TYPES: ALL RESPONSES
# RESPONSES	43	11	24
# DAYTIME ADJ'S MEAN # ADJ'S/WK	1.00	.50	.90
ZERO PER WEEK	58.54	60.00	58.82
ONE PER WEEK	12.20	30.00	15.69
TWO PER WEEK	12.20	10.00	11.76
THREE PER WEEK	9.75	0	7.84
FOUR OR MORE/WK	7.32	0	5.84
# NIGHTTIME ADJ'S MEAN # ADJ'S/WK	.95	.56	.88
ZERO PER WEEK	30.17	55.56	35.42
ONE PER WEEK	48.72	33.33	45.83
TWO PER WEEK	17.95	11.11	16.67
THREE PER WEEK	0	0	0
FOUR OR MORE/WK	2.56	0	2.08
ELEV EASY ADJ MEAN # ON SCALE FROM 1 to 5*	4.60	3.27	4.33
% STRONGLY AGREE	65.12	0	51.85
% AGREE	30.23	72.73	38.89
% NEUTRAL	7.65	0	3.70
% DISAGREE	0	9.09	1.85
% STRONGLY DISAGREE	0	18.18	3.70

AZIMUTH ADJ'S ALL SITES

54	
# OF TOTAL ADJ'S	
ZERO	4.74%
ONE	33.96%
TWO	11.32%
THREE	15.09%
FOUR	7.55%
TEN OR MORE	20.75%
AZIMUTH EASY ADJ MEAN # ON SCALE FROM 1 to 5*	3.47
% STRONGLY AGREE	32.56
% AGREE	23.26
% NEUTRAL	20.93
% DISAGREE	4.65
% STRONGLY DISAGREE	18.60

* Scale:

5	4	3	2	1
Strongly Agree				Strongly Disagree

1. A predominant number of site operators, either equipped or not equipped with electric motors, found that elevation adjustments were easy to make.
2. The number of site operators who found that the adjustments were easy to make was greater among operators equipped with motors than operators not equipped with motors.
3. A greater number of both daytime and nighttime adjustments were made by site operators equipped with motors than by those not equipped with motors.
4. The number of nighttime elevation adjustments by operators equipped or not equipped with motors, was greater than the number of daytime adjustments.

Parabola adjustments for STD nighttime programs were more critical than daytime adjustments. For example, nighttime signals at many STD remote sites could not be received without elevation adjustments. Thus, the STD concluded that site operators could increase signal quality if they were equipped with electronic mechanisms, which were convenient and east to operate.

The November, 1975 survey was revised slightly in April, 1975 to provide information about less frequent azimuth adjustments. The revised questionnaire determined how many times (since the beginning of the Project) an azimuth adjustment had been done at a particular installation.

April survey results indicated that: 34.0 percent of the site operators made zero adjustments from September to April; 11.3 percent made one adjustment; 15.1 percent made two adjustments; and 7.6 percent made three adjustments. In addition, 55.8 percent of the operators thought azimuth adjustments were easy to make ("agree" or "strongly agree"); 20.9 percent had no opinion; and 23.2 percent thought adjustments were difficult to make ("disagree" or "strongly disagree").

The azimuth adjustments were difficult to make. Indeed, under certain conditions, site operators could not swing the heavy parabola. For this reason, the STD suspected that those people with neutral opinions or those with positive responses were primarily people who were not performing adjustments or who were making the adjustments infrequently.

Consequently, because of the high quality of signal received throughout the Project, two interrelated conclusions have been drawn:

1. At a predominant number of STD sites, it was unnecessary to make more than one or two azimuth adjustments throughout the Demonstration.
2. A small number of installations (which were close to the edge of the footprints) needed to make more frequent adjustments (about once a month) for optimum signal reception, but did not because these adjustments were difficult.

VHF Transmitter/Receiver System

By operation of a single, inclusive indoor unit--the VHF Communications Console--the site operator received voice messages and transmitted voice and data information. The Console was operated by simple on/off switches and push-button controls, with indicator lights providing additional assistance.

The Console was designed to serve as an inclusive and simple-to-operate device for performing reception and transmission functions. Table 5 and Table 6 present data about "how easy" and "how interesting" the Console was to use.

That the VHF Communications Console was tremendously successful from an ease-of-operation standpoint was clear from the results of both surveys, which show 100 percent "easy-to-operate" opinion ("agree" or "strongly agree"). Further, coupled with the result that a predominate percentage found it interesting to use (95.2 percent in the November, 1974, survey, and 95.7 percent in the April, 1975, survey), easy operation should be considered as contributing to "user acceptance."

SUMMARY

This paper described the site operator training program that was developed by the STD's Broadcast and Engineering (B & E) Component. Presented below are some highlights of that program and some recommendations for future projects.

At the beginning of the Demonstration, B & E compiled a site operator profile. The profile showed that, prior to joining the STD, the operators had no special interest, training, or capability in satellite communications equipment. They were, however, familiar with modern technology, and they had varying degrees of interest, training, and capability in other communications equipment (for example, photography, audio-visual systems, and mechanics).

TABLE 5
STD SURVEY
NOVEMBER 1974
VHF COMMUNICATIONS CONSOLE

# RESPONSES		21
EASY TO USE		
MEAN # ON SCALE FROM 1 TO 5*	4.76	
% STRONGLY AGREE		76.19
% AGREE		23.81
% NEUTRAL		0
% DISAGREE		0
% STRONGLY DISAGREE		0
INTERESTING TO USE		
MEAN # ON SCALE FROM 1 TO 5*	4.57	
% STRONGLY AGREE		71.43
% AGREE		23.81
% NEUTRAL		0
% DISAGREE		0
% STRONGLY DISAGREE		4.76

TABLE 6
STD SURVEY
APRIL 1975
VHF COMMUNICATIONS CONSOLE

# RESPONSES		21
EASY TO USE		
MEAN # ON SCALE FROM 1 TO 5*	4.71	
% STRONGLY AGREE		70.83
% AGREE		29.17
% NEUTRAL		0
% DISAGREE		0
% STRONGLY DISAGREE		0
INTERESTING TO USE		
MEAN # ON SCALE FROM 1 TO 5*	4.61	
% STRONGLY AGREE		69.57
% AGREE		26.09
% NEUTRAL		0
% DISAGREE		4.35
% STRONGLY DISAGREE		0

* Scale:

5	4	3	2	1
Strongly Agree				Strongly Disagree

B & E then developed materials and strategies that were effective in training the operators described above. The Site Operator Manual, for instance, was easy to read and nontechnically oriented; it was written so that any site operator, regardless of past interest, training, or capability could perform the necessary engineering and research tasks.

The training program was successful. STD site operators performed effectively throughout the Demonstration.

Part of the success is, perhaps, traceable to how the site operators felt about using the equipment, following specified procedures, and collecting technical data. Overall, there was close to 100% agreement that: (1) B & E equipment was easy to use; (2) B & E operational procedures were interesting and easy to follow; and (3) B & E data-gathering requirements were easy to fulfill.

A more detailed analysis of site operator preferences showed that:

1. Manual parabola elevation adjustments were easy to make.
2. Electric parabola elevation adjustments were easier to make.
3. The number of parabola elevation adjustments increased when the adjustments were easier to make.
4. Parabola azimuth adjustments were difficult.
5. The VHF communications console was easy, interesting, and enjoyable to operate.

Based on the above findings, B & E recommends that future planners:

1. Hire site operators not fewer than two months prior to operations to train them and to evaluate how effectively they will perform.
2. Train substitute personnel to fill in for the usual site operators during personal absences.
3. Equip all parabolas with electric elevation adjustment devices; if funds are limited, equip only "critical sites" with electric devices.
4. Design a new and easier azimuth adjustment device.
5. Allocate money, time, and manpower to training site operators not only in operating the equipment, but also in making simple maintenance checks and repairs, such as changing fuses and fixing connectors.

In sum, the training program designed by B & E was worth the time, money, and manpower that was spent in the development and implementation. The HET experiments demonstrated that competent site operators help to increase the effectiveness of a satellite distribution system.

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